

FVTX TRIGGER PARAMETER OPTIMIZATION

Constraints and Options

- Suppose 400 Hz total band width
- 2 trigger bits are available. Following 2 options are available:
 1. North & BBC_narrow + South & BBC_narrow
 - Optimize thresholds to satisfy 200Hz for each trigger
 2. (North&South)&BBC_narrow + (North || South)&BBC_narrow
 - How much fraction better be assigned to AND and OR trigger mix, respectively?

Single Trigger Optimization

BBC rate ~ 1MHz.

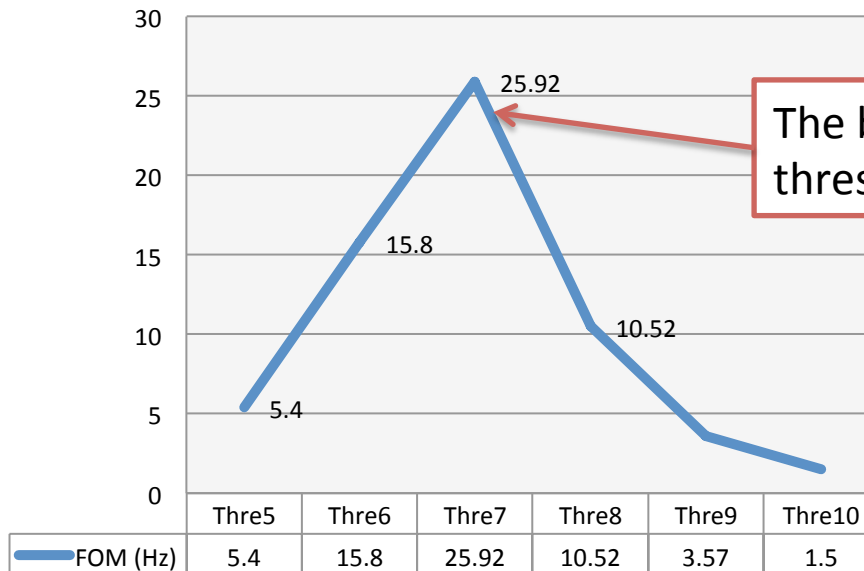
Threshold/cage	5	6	7	8	9	10
Purity >= 20	0.027	0.079	0.162	0.263	0.357	0.6
Efficiency*	1	1	1	1	1	1
Rates (Hz)	2560	640	160	40	10	2.5
Prescale**+1	12.8	3.2	1	1	1	1
FOM*** (Hz)	5.4	15.8	25.92	10.52	3.57	1.5

*Efficiency was assumed ~ 1 due to insufficient statistics.

** Prescale factor was calculated assuming 200Hz/arm

*** FoM = Purity * Efficiency/ (Prescale+1) * rates [Hz] (rates of >20 tracks)

FOM (Hz)



The best FoM is given by threshold >=7 (14/arm)

This condition can run without prescale upto BBC rate ~ 1MHz

Single Trigger Turn On Curve

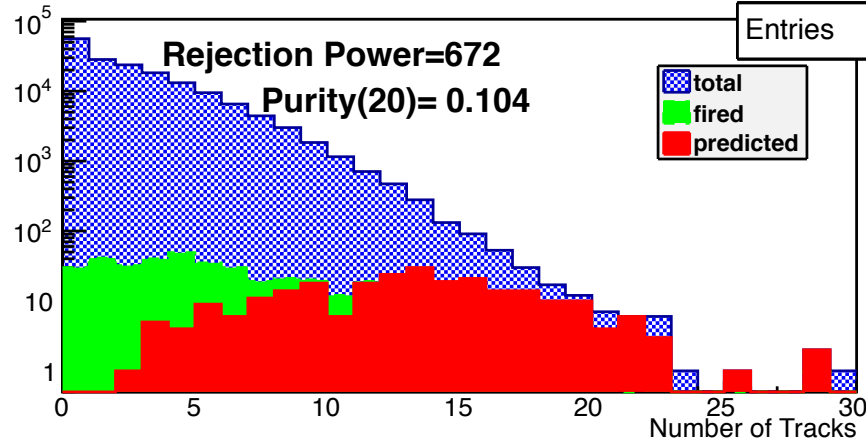
See only red predicted dots and hists. Ignore green dots/hists. The data was taken in different condition.

Number of Tracks per Event (South)

Entries 250

Rejection Power=672

Purity(20)= 0.104

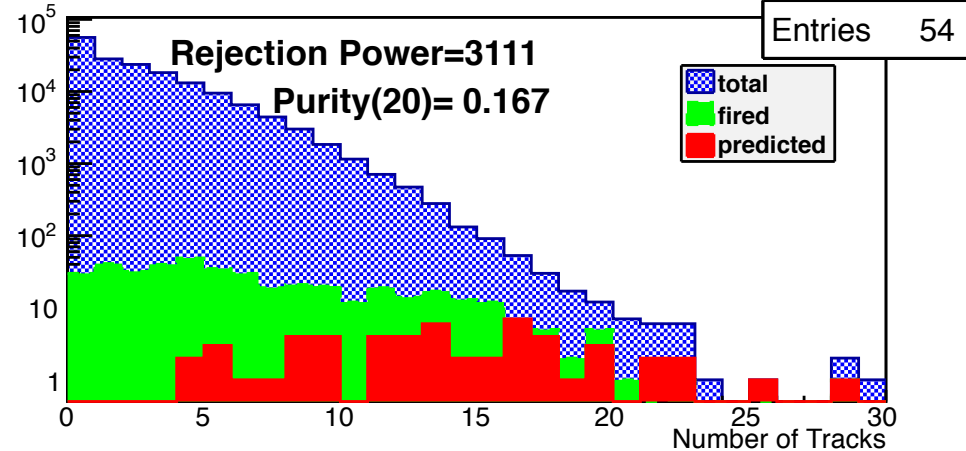


Number of Tracks per Event (South)

Entries 54

Rejection Power=3111

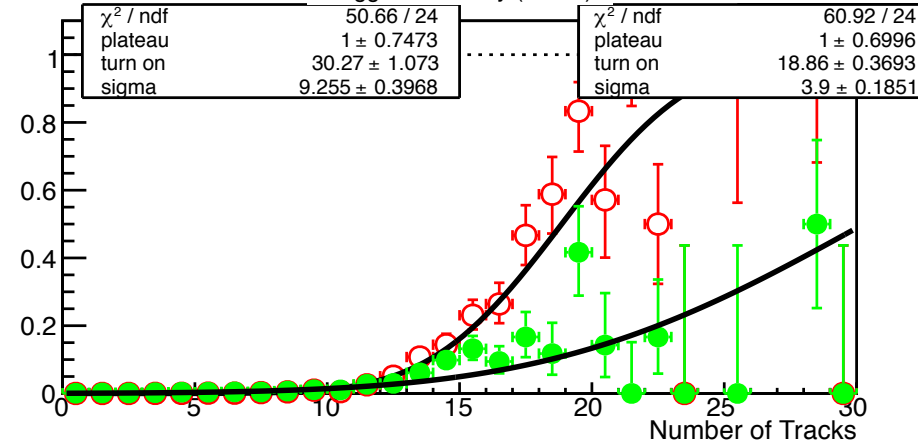
Purity(20)= 0.167



Trigger Efficiency (South)

χ^2 / ndf 50.66 / 24
plateau 1 ± 0.7473
turn on 30.27 ± 1.073
sigma 9.255 ± 0.3968

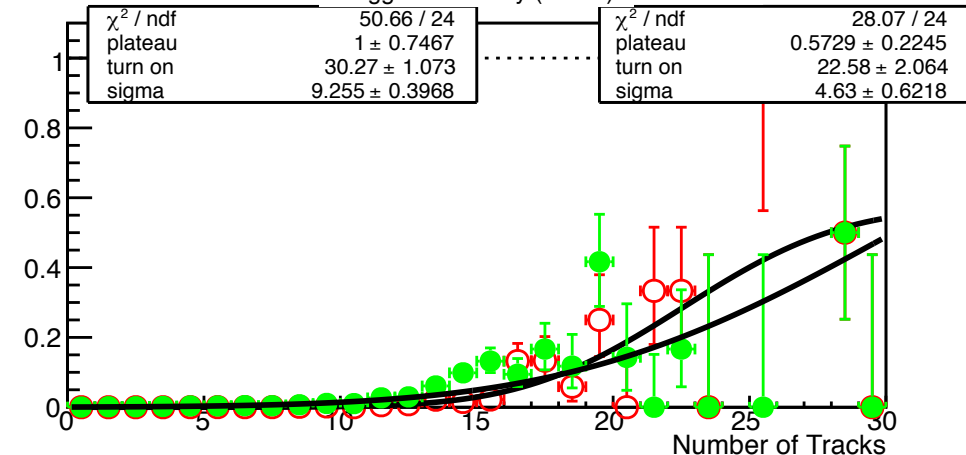
χ^2 / ndf 60.92 / 24
plateau 1 ± 0.6996
turn on 18.86 ± 0.3693
sigma 3.9 ± 0.1851



Trigger Efficiency (South)

χ^2 / ndf 50.66 / 24
plateau 1 ± 0.7467
turn on 30.27 ± 1.073
sigma 9.255 ± 0.3968

χ^2 / ndf 28.07 / 24
plateau 0.5729 ± 0.2245
turn on 22.58 ± 2.064
sigma 4.63 ± 0.6218



track $\geq 12/\text{arm}$

track $\geq 14/\text{arm}$

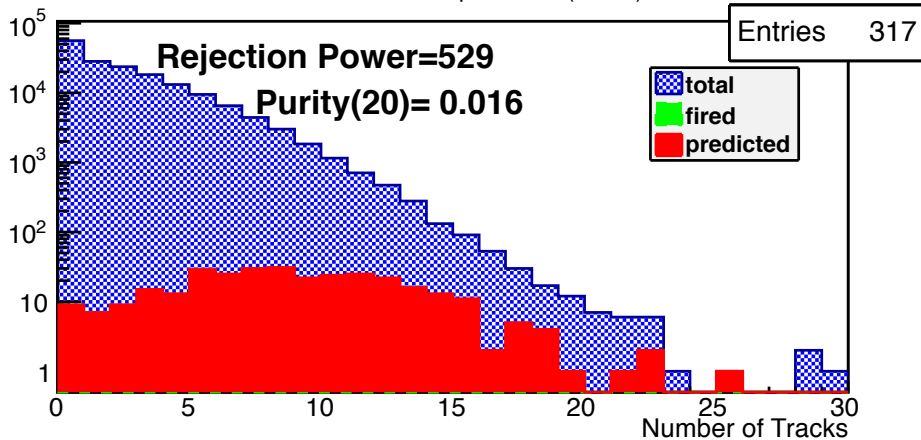
North&South Coincidence

Threshold/ cage	Coinc Counts	Coinc Rates [Hz]	Precale	Efficiency	Purity>20	FoM [Hz]
4	317	500	2.25	1	0.016	3.56
5	64	100	1	1	0.062	6.20
6	16	27	1	1	0.188	5.08
7	1					

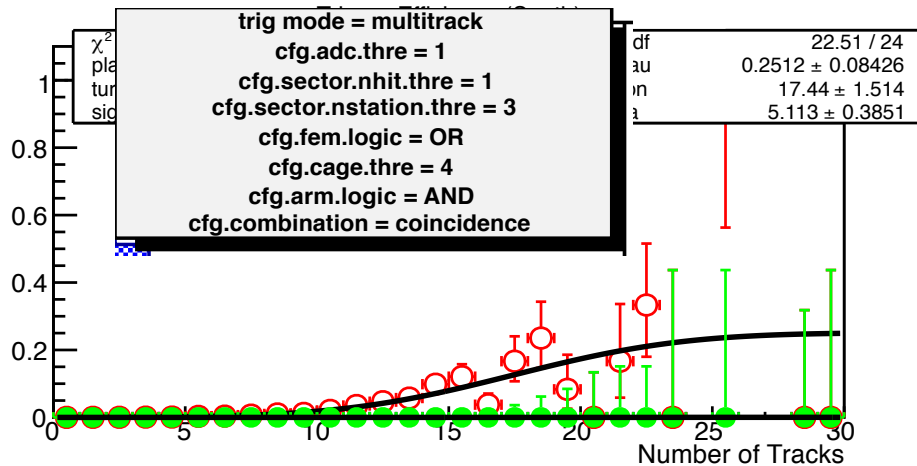
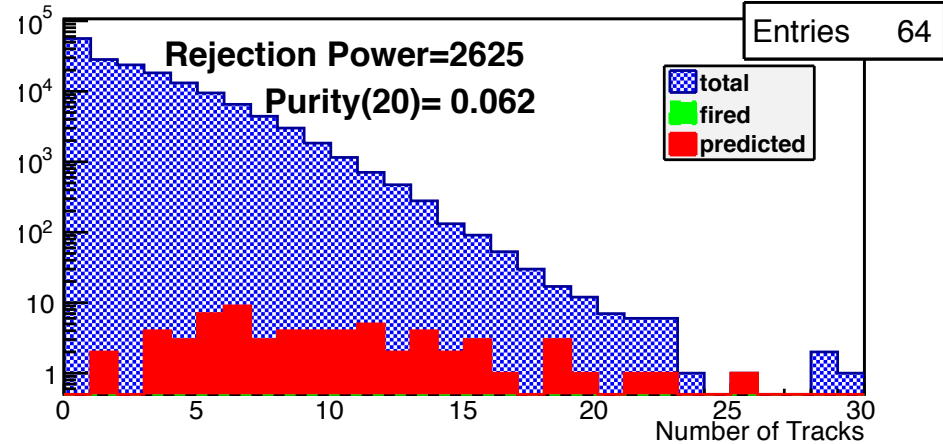
- The best parameter is the threshold ≥ 5 (10/arm) which provide 6.2Hz trigger rates of greater than 20 tracks/arm (40tracks/both_arm) event.
- The coincidence rates is 100Hz at BBC ~ 1 MHz. Rest of 300Hz can be assigned to North or South trigger (2.5kHz/arm @ BBC rate of 1MHz).

Coincidence Trigger Turn on

Run#425931 (MB Samples)

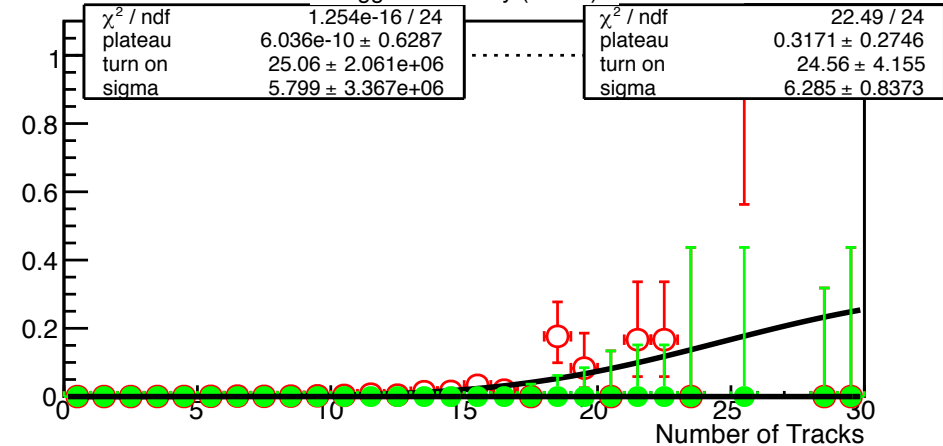


Number of Tracks per Event (South)



of track Threshold $\geq 8/\text{arm}$

Trigger Efficiency (South)



of track Threshold $\geq 10/\text{arm}$

Summary

1. North & BBC_narrow + South & BBC_narrow option:

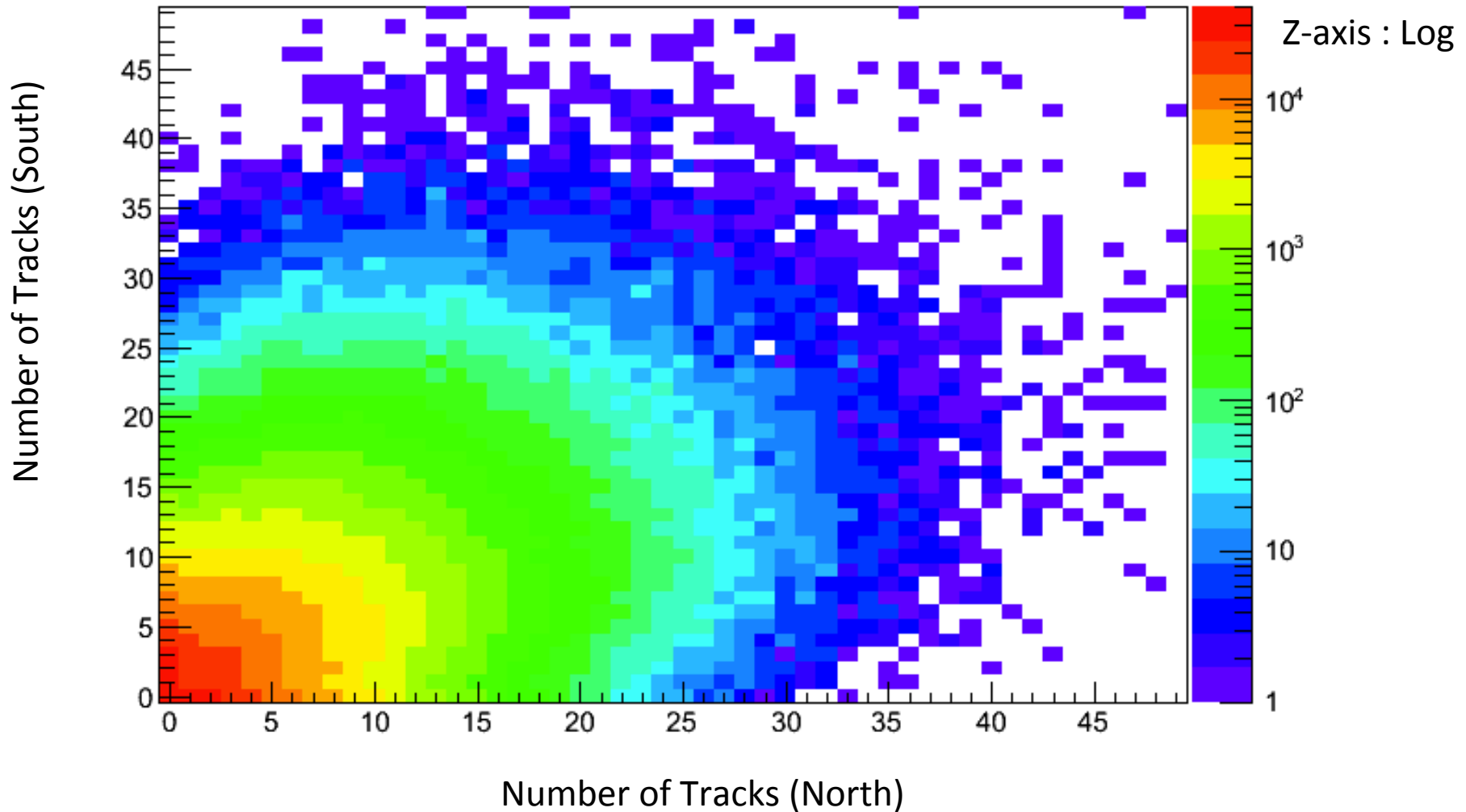
- Run with threshold $\geq 14/\text{arm}$
- Accumulate > 20 track/arm events about $\sim 25\text{Hz}$.

1. (North&South)&BBC_narrow + (North|| South)&BBCnarrow

- Run with threshold $\geq 10/\text{arm}$
- Accumulate > 40 track/both_arm events about $\sim 6\text{Hz}$
- Accumulate > 20 track/arm events about $4\sim 5\text{Hz}$.

NORTH AND SOUTH TRACK CORRELATION

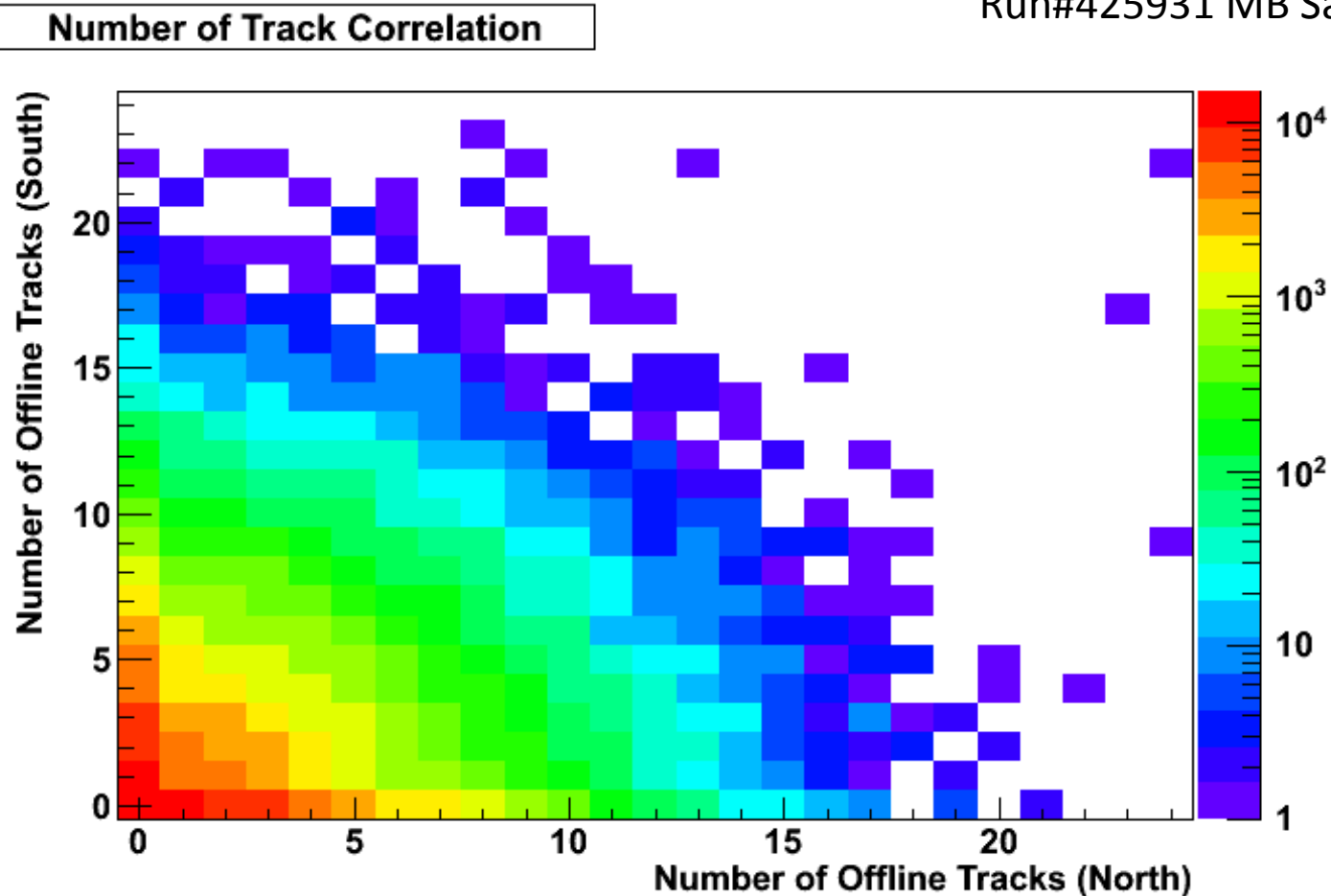
North vs. South Correlation @ 500GeV



Correlation is seen after analyzing x10 statistics and plotting as log for z-axis. However it is broad and much weaker correlation compared to W and E.

North vs. South Offline Track Correlation @ 200GeV

Run#425931 MB Samples

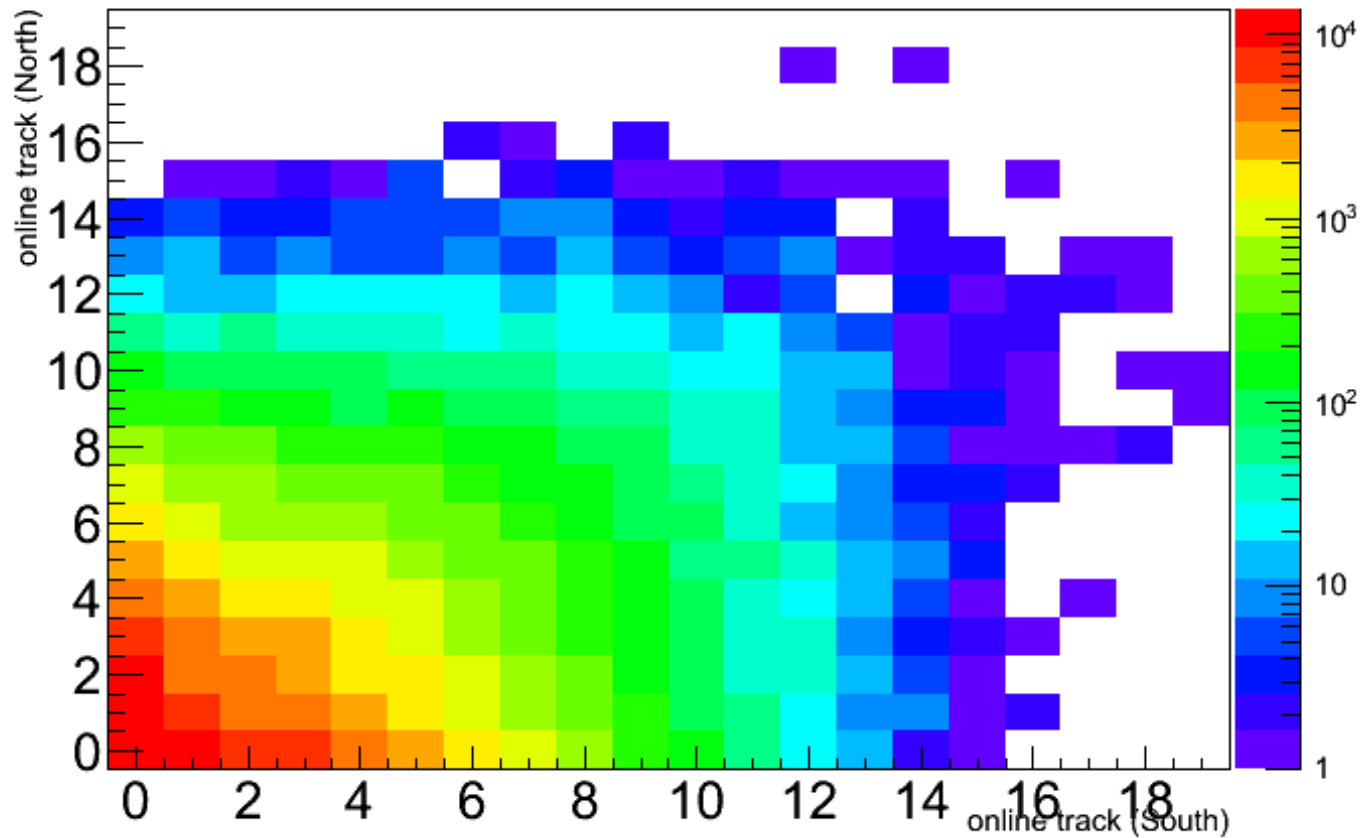


Correlation seems weaker compared to 500GeV case.

North vs. South Online Track Correlation @ 200GeV

Online ntrk correlation

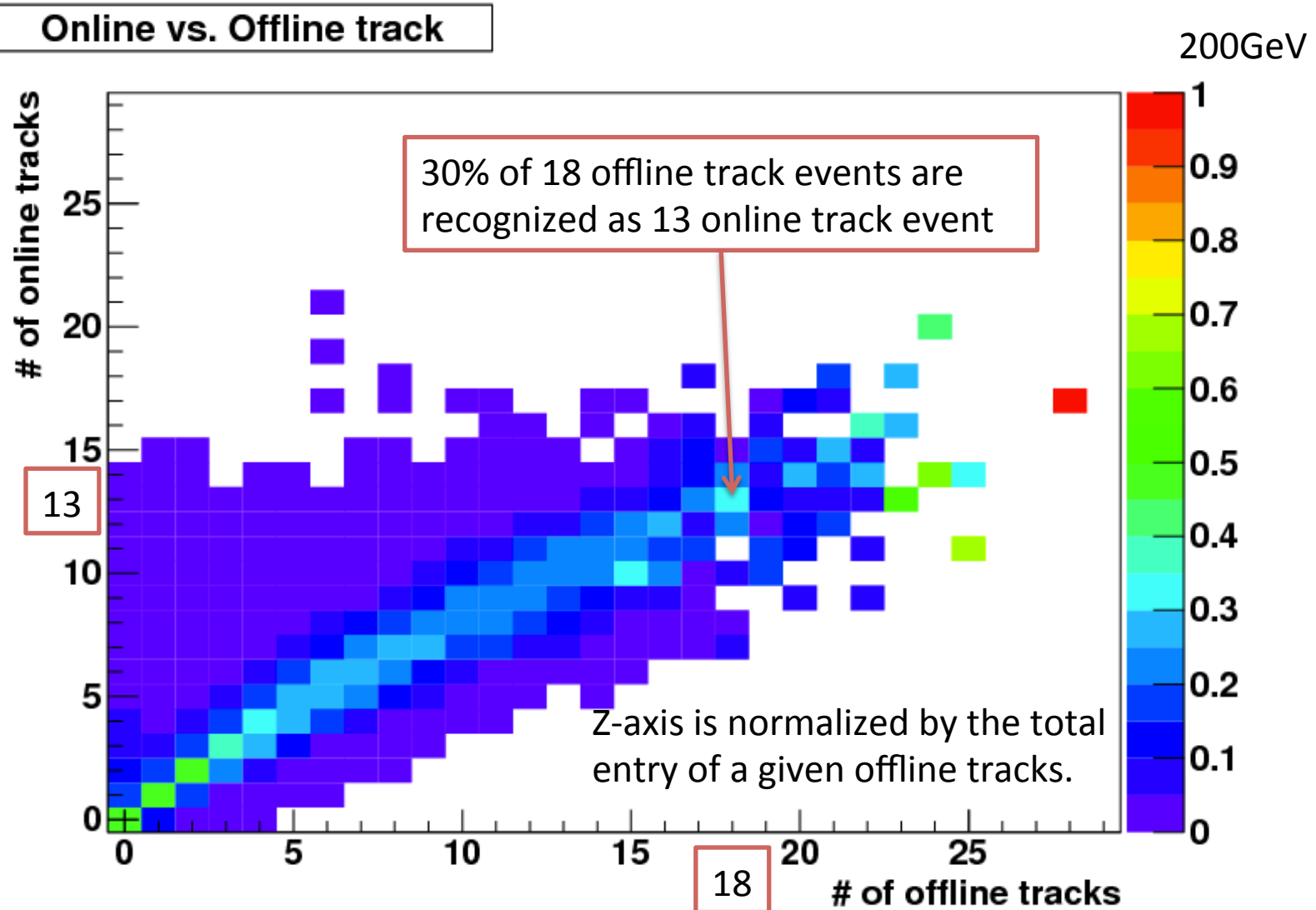
Run#425931 MB Samples



Correlation between North and South number of tracks (active $\frac{3}{4}$ wedges per FEM).
Again the correlation is weak.

ONLINE TRACK VS OFFLINE TRACK

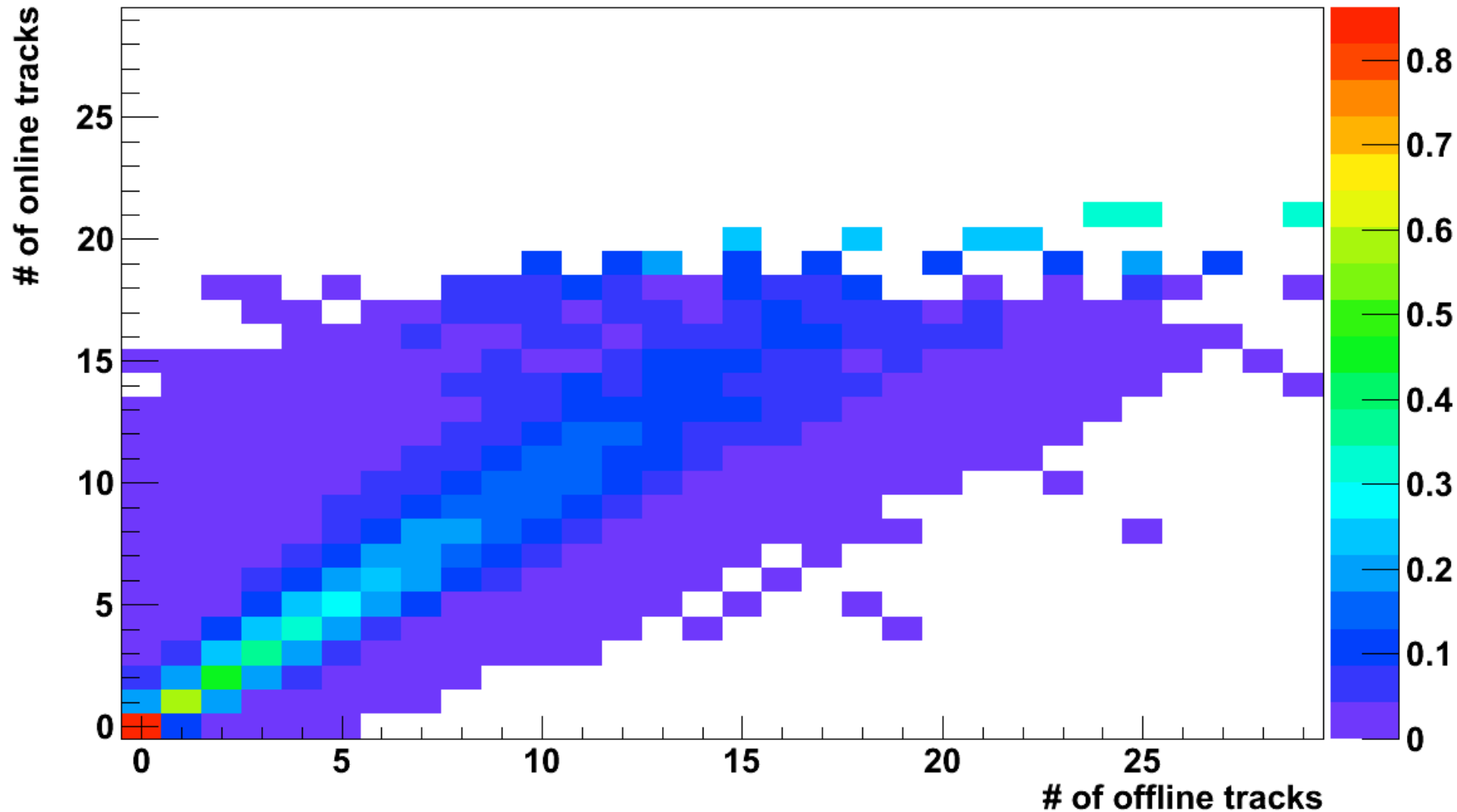
Online vs. Offline Track Correlation



Online track (=active FEMs) is limited upto 24/arm. Therefore the curve saturates at higher #of tracks

Normalized by Online Track

Online vs. Offline track : Normalized by # of online tracks



Online vs. Offline track : Normalized by # of offline tracks

